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The Fog on New Year's Day

In London and the south-eastern part of England the New Year opened with one of the worst fogs experienced in these districts for many years. Traffic by road, rail and air was seriously disorganised, and several people lost their lives as a result of the poor visibility.

At 18h. G.M.T. on the last day of 1933 the barometric situation showed a depression some distance to the west of Iceland and another over the Mediterranean Sea. Between these two lay an elongated high pressure system extending from Scandinavia to the Azores and passing over central England, where a local maximum was indicated. Thus over Ireland and Scotland the isobars were roughly south-west to north-east, while over most of England and Wales the barometric pressure was very uniform. In this area of small pressure gradient the winds were very light, and there was little cloud except along the east coast of the southern half of England. Here the air moving round the local " high " over England just referred to encountered the comparatively cold air from the continent, and so caused a certain amount of cloud. Visibility was poor though hardly anywhere was it less than 1,100 yds. Thus conditions were very favourable for the formation of a " radiation fog."

By 7h. G.M.T. on the following morning (January. 1st, 1934) many places in the south-east part of England and the Midlands

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were experiencing a visibility of less than 500 yards except along the east coast of the home counties, where the cloud had prevented the formation of fog. Meanwhile, however, the depression which had been to the west of Iceland had moved eastwards and was centred just south-east of Iceland. This caused an increase in the pressure gradient over the north-west of England. The resulting increase in wind, and the cloud which arrived with it, dispersed any fog which was tending to form there.

By 10h. G.M.T. the wind had fallen still more in most places in south-east England and the Midlands, and a thick fog covered this part of the country except on the east coast.

At 13h. G.M.T. the visibility at Croydon was less than 55 yards, and in many places in London and the suburbs large objects were quite hidden at distances of 12 yards or more. The general situation was already showing signs of improving, however. The depression near Iceland had moved slightly north-east and had deepened, and the wedge of high pressure over England had moved slightly south-east. These changes brought freshening winds from between S. and W. to an increasing area and the Midlands by now were practically clear of fog, though visibility was still not good.

The depression over Iceland continued to deepen and by 18h. G.M.T. most of the country except London and the suburbs was practically clear. The information available suggests that the southern parts of London cleared first. In the neighbourhood of Croydon the fog had completely gone by about 18h. 30m. G.M.T. In central London it persisted to a later hour, and in some of the northern districts such as Golders Green and also in the west along the river valley a thick fog lasted until after 23h. G.M.T. By the morning of January 2nd, however, conditions were back to normal.

From reports received so far it would appear that the area within a radius of about twenty miles of the centre of London suffered more than any other part of the country, though the fog was very thick further westward. In the London area the fog thickened considerably during the afternoon, and while it was most dense houses were invisible across an ordinary street. Street lamps with single incandescent mantles were hidden at about 15 yards and the green signal of some traffic-control lights at about 20 yards; the amber light, of course, showed a greater penetrating power. Normal unilluminated objects such as telegraph poles or pedestrians were hidden at distances of about 5 to 8 yards in places. During the homeward rush hour all transport services were dislocated, in one district conditions were so bad that some factory workers, familiar with the locality, walked off a path into a river. Throughout the day aircraft were prevented from leaving or landing at Croydon. In central London the fog does not appear to have been of great depth.

At about 14h. G.M.T. there was little fog at a height of about 45 feet in Kingsway, whereas in the street it was already of considerable density. Looking westwards along the Strand at about the same hour one could see enormous masses of black fog coming up in banks and separated by relatively clear patches in their upper parts.

In its general character the fog was in many ways similar to the London " particulars " of 30 years ago. The main difference was that the fog was not yellow in colour, and evidently did not contain so much of the choking sulphurous products of burning coal which was so characteristic of the older fogs. In recent years the centre of London has frequently been almost free from dense fog on the ground on occasions when the suburbs have experienced this phenomenon. This is attributable mainly to the relatively high temperature of the air in central London, due largely, it is supposed, to the prevalence of central heating in the numerous large buildings which have been recently erected, coupled with the cleaner streets and the greater areas now covered with waterproofed surfaces. The general effect of the increased temperature has been to raise a radiation fog to a height of the order of 1,000 ft. Such high fogs are the commonest type of fog now experienced in central London.

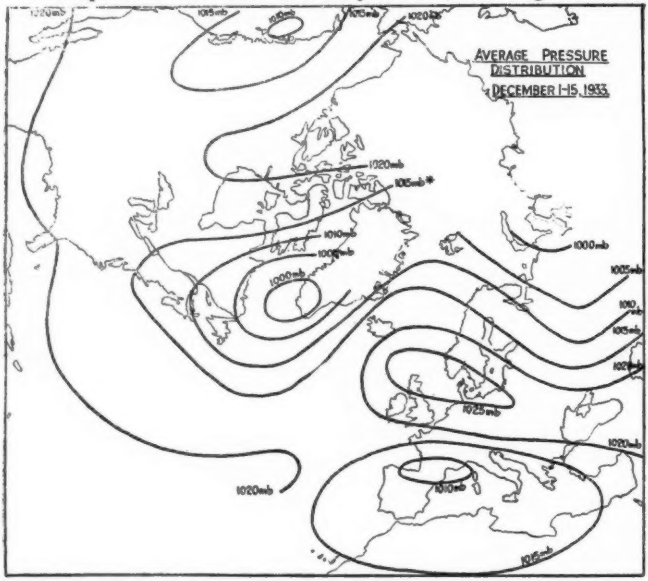
It is not yet clear why the fog of January 1st did not take the form of high fog. Possibly the explanation is to be found in the naturally stable thermal structure of a radiation fog combined with the fact that the air in the south-westerly drift, which eventually cleared the fog away, was appreciably warmer than the air it replaced. These two factors combined may have been responsible for keeping the fog on the ground.

A. C. BEST.

The Pressure Distribution during December, 1933

The greater part of December was marked in England by an abnormal frequency of easterly winds and an intensification of the drought which had prevailed more or less throughout the year. The month opened with an intense anticyclone over Scandinavia and a depression over the northern Atlantic with two deep centres west of Iceland and over Newfoundland, which soon coalesced to form a deep depression almost stationary south of Greenland. On the 2nd the Scandinavian anticyclone began to spread south-westwards, and by the 9th extended from Scotland to Roumania. From the 11th to the 15th the main high-pressure centre lay over the Atlantic, and pressure was lowest near Newfoundland. The average pressure distribution during December 1-15th is shown in the figure. The pressure difference between Julianehaab, in the south of Greenland, and Lerwick was 29 mb.,

giving strong southerly winds over Iceland, where the average 7h. temperature was above 40° F. Over England and Ireland there was a definite gradient for easterly winds, and the average 7h. temperature at Kew was only 33° F., ten degrees below



Reykjavik. Another feature of the map is the area of almost uniform high pressure which covered the greater part of North America.

After December 15th conditions slowly changed. The depression off Newfoundland began to advance eastward, becoming complex, and the anticyclone retreated across the British Isles, reaching France on the 24th, but it was not until Christmas Day that cyclonic conditions spread over these islands. Even then the pressure distribution remained complex, and low temperatures persisted in England until the end of the year.

Reduction of Temperature to Sea Level. The "Cold Pole"

By S. T. A. Mirrlees, M.A.

In this country there are so few stations at an altitude of more than six or seven hundred feet that " reduction to sea level " seldom gives rise to any question.

Where there are extensive mountainous areas, and particularly for the winter season, where a large inversion of temperature at the surface may be the normal state, matters are not so simple and in the text accompanying the recently published atlas of temperature in Asiatic Russia* the question of reduction of temperature is discussed at some length.

No satisfactory solution of the problem has been found, and the isotherms are given as reduced to sea level by the addition of 0·5°C. per 100 m., but the lines for the winter months are shown dotted over the higher mountainous parts of north-eastern and eastern Siberia, and over lofty plateau regions such as the Pamir, isotherms are omitted.

The mean temperature for the month of January over a long period at Verkhoiansk is -58°F., and at Jakutsk, -46°F. On the southern slope of the mountain range between these two stations observations have been taken for a short period at Semenovski mine, at an elevation some 900 metres above the first-named stations; the mean temperature for January there, reduced to a long-period mean† is -21°F., and in this case the usual method of reduction to sea level breaks down, the addition of 8°F. to the temperature at the Semenovski mine station serving only to increase the anomaly. However true may be the remarks of Woeikov, quoted in the text, to the effect that the drawing of isotherms for the high ground of Central Asia is merely an exercise in drawing lines, there seems no reason why some of the boldness with which isohyets are often based on scanty data might not be applied to the drawing of isotherms. Fig. 1 is an impressionist attempt to show isotherms of actual temperature for the region in the vicinity of the "cold pole" of Siberia—or rather "poles" for, as mentioned by Dr. C. E. P. Brooks in a review‡ of the atlas, the cold pole is in reality "a series of valleys and pockets of the earth's surface, rather than a definite region."

In Fig. 1 the isotherms are at intervals of 10°F.; the isotherm in the region of Oimekon is that of -60°F. The stations are indicated by the initial letters; V, Verkhoiansk; S, Semenovski Mine; J, Jakutsk; O, Oimekon. The contours are those of 500 and 1,000 metres, ground above 1,000 metres being shaded.

Isotherms so drawn do at least take account of such data for high levels as are available and probably give a good approximation to the facts where the topography is such that free drainage of cold air from the high stations is possible, but not in the case of enclosed basins. An example is quoted in the text of the

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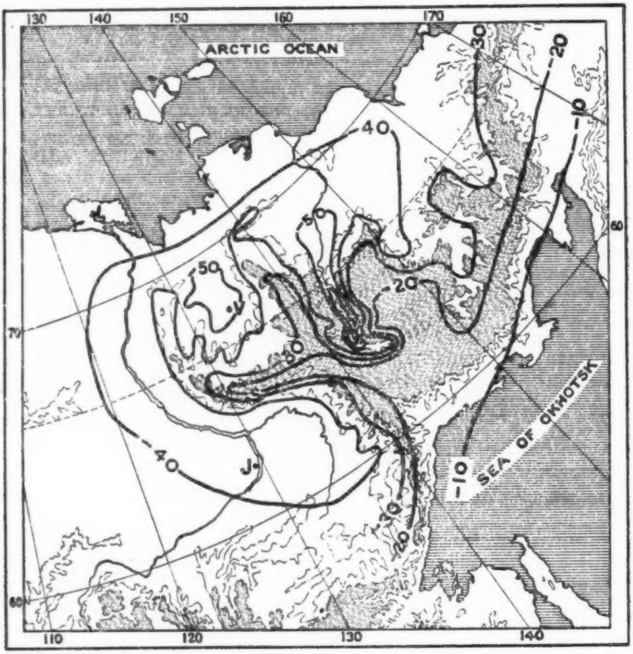
* Klima der U.S.S.R., Teil 1, Lief. 3, Monatsmitteln der Lufttemperatur im Asiatischen Teil der U.S.S.R. Von. E. Rubinstein, Leningrad, 1931: Atlas, 1932.

†Schostakowitsch, Contributions à l'étude du climat de la republique Iakoute, Leningrad, 1927.

‡*London, Q.J.R. Meteor. Soc.*, **59**, 1933. p. 285.

atlas: the station Semipalatinsk lies in nearly the same latitude as, but 1,618 metres lower than, Kosch-Agatsch, and has a mean temperature for January 26°F. warmer; the high-level station in this case is surrounded by higher ground and presumably subject to greater cooling. The same considerations presumably apply to the station in the Oimekon basin of the upper Indigirka River (63° 16′ N., 143° 13′ E., 658m. above M.S.L.), where in 1930 a mean temperature for January was recorded 8½°F. lower



than that at Verkhoiansk. The Oimekon station was set up by Professor Obrutschev, the Russian geologist who explored the region in 1926, and who was the first to draw attention to the possibility that a region experiencing lower temperatures than Verkhoiansk had been discovered*; although the station has not been in action long enough for the probable mean temperatures to be stated accurately, it seems likely that the normal for January is below −60°F. and the isotherms on Fig. 1 have been drawn on this assumption.

The region has not been sufficiently explored, in the

*London, *Geog. J.*, **70**, 1927, p. 469.

meteorological sense, for it to be stated that there are no other "cold poles." So far as is at present known the inverted lapse-rate, as shown by data from pairs of neighbouring stations reaches an average of 1° to 2° per 100 metres in January. In particular instances these figures may be considerably exceeded, a case being quoted where the inversion as shown by observations at 7h. at neighbouring stations was 20·7°C. in 450m. (37°F. in 1,480 feet).

The importance of such inversions of temperature in the reduction of barometric observations is evident; a rough calculation shows that under average conditions in January the reduced pressure at Semenovski mine, if the ordinary barometric tables are used, would be given as 6mb. low.

Discussions at the Meteorological Office

The subjects for discussion for the next two meetings are:—

January 29th, 1934.—*The absorption of sound in the atmosphere: a tentative explanation.* By Yves Rocard. (J. Phys. Radium, Paris. Vol. 55, Series 7, 1933, No. 3) (in French). *Opener.*—Mr. H. L. Wright, M.A.

February 12th, 1934.—*On the electric charge collected by water-drops falling through ionized air in a vertical electric field.* By J. P. Gott (London, Proc. R. Soc. A., Vol. 142, 1933, pp. 248-68), and *Some thundercloud problems.* By C. T. R. Wilson (Philadelphia, J. Frank. Inst., Vol. 208, 1929, pp. 1-12). *Opener.*—Mr. F. J. Scrase, M.A., B.Sc.

Royal Meteorological Society

The monthly meeting of this Society was held on Wednesday, December 20th, at 49, Cromwell Road, South Kensington, Prof. S. Chapman, F.R.S., President, in the Chair.

Mr. James Fairgrieve exhibited a film showing the variation of rainfall areas during a thunderstorm.

Dr. F. J. W. Whipple gave an account of recent investigations relating to the propagation to great distances of airwaves from gunfire.

J. Glasspoole, M.Sc., and W. L. Andrew — The Exceptional Summer of 1933.

The paper gives details of the unusual weather of the summer of 1933, and compares it with that experienced in earlier exceptional years.

The sunshine recorded over the British Isles exceeded the average in each of the four months June to September, the mean excesses being 21, 17, 35, and 33 hours, respectively. During this period many places in the south-east of England registered more

than 1,000 hours of bright sunshine, nearly 200 hours more than usual. The total sunshine during these four months fell short, however, of that recorded during June to September, 1911.

The mean temperature over the country generally exceeded the usual value in each month February to October. July, 1921, was as warm as July, 1933, and these two Julys rank as the warmest on record. The mean temperature of August, 1933, fell short of that of the Augusts of 1911 and 1899. (The highest shade temperature recorded at Greenwich Observatory since 1841, viz., 100·0° F., occurred on 9th August, 1911, while August, 1899, is the warmest calendar month on record for the British Isles as a whole.) September, 1933, was not quite as warm as the recent September of 1929, while September, 1895, was appreciably warmer. The outstanding feature of the summer of 1933 was the warmth of June to September as a whole, the mean temperature over the British Isles exceeding that of any similar period since before 1881.

The total rainfall over the British Isles during the six summer months April to September was 13·8 in., and less than that of any summer since 1870, except 1870 with 12·4 in., 1921 with 13·1 in., and 1887 with 13·7 in. The incidence of the rainfall during 1933 added to the difficulties of many water undertakings in arranging for an adequate water supply. Rainfall was abundant in February and many reservoirs were overflowing at the beginning of April. Subsequently, the slightly deficient rainfall of each month April to July, culminating in an unusually dry August, together with the loss by evaporation, resulted in a steady lowering of the level of the water in most reservoirs. Much of the rain which fell in the summer and autumn was not sufficiently prolonged to give appreciable run-off. (The rainfall was about normal in October, but the return to dry weather in November and December naturally added to the difficulties in many localities.)

The paper also includes diagrams designed to bring out the integrated effects of the variations in the weather during the whole summer period, and a note dealing with the effect of the unusual weather on the crops at Rothamsted.

Correspondence

To the Editor, *The Meteorological Magazine.*

Underground Water Level at Kew Observatory

The float of the water level recorder has been resting on the bottom of the well since August 17th, 1933. On November 6th the pump in the garden was removed, and soundings were taken in the boring. It was found that the level of the water was then 127 cm. above M.S.L. The lowest level which can be recorded inside the Observatory is 154 cm. By the end of the month the level in the boring had hardly changed.

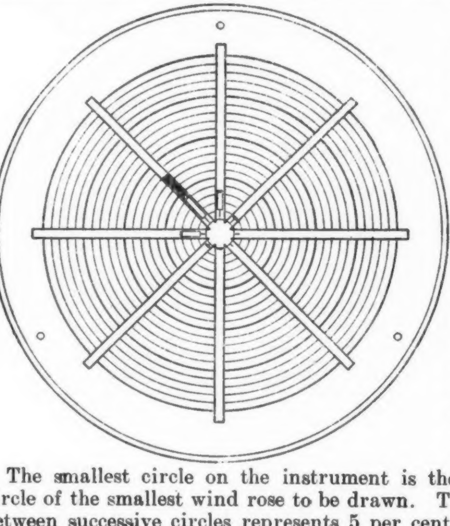
This is the first time since the recorder was installed in July, 1914, that the float has rested on the bottom for such a long time. In 1929 the float rested for 13 days. It is remarkable that the water was never so low during the very dry year 1921. It is said that very little water is passing the locks on the Thames. Whether the engineering works in the neighbourhood—the building of Twickenham Bridge and the construction of large sewage works at Isleworth and the construction of wells by the Richmond Corporation in the Old Deer Park—can have affected the level of the underground water is an open question.

F. J. W. WHIPPLE.

December 9th, 1933.

An Instrument to facilitate the Drawing of Wind Roses

The drawing of wind roses in large numbers on a small-scale map is tedious work, and unless considerable care is used, it is difficult to attain a neat result. The instrument described in this note has been devised to render this operation quick and easy, it being possible to draw a neat eight-point rose, indicating light, moderate, and strong winds, in less than two minutes. A simple rose indicating only the total frequencies from each direction, may be drawn in a few seconds.



The instrument, which is made from a piece of transparent celluloid about 0·065 in. thick, is shown full size in the figure. The dimensions may of course be varied to suit the scale of the wind roses which it is desired to draw.

The smallest circle on the instrument is the size of the base circle of the smallest wind rose to be drawn. The radial interval between successive circles represents 5 per cent. of frequency on the desired scale, in this case 1 inch to 100 per cent. Obviously, there will be no difficulty in drawing roses with a scale of

2 inches to 100 per cent., each interval then corresponding to $2\frac{1}{2}$ per cent. Each fifth circle is cut slightly deeper to facilitate counting.

The eight radial slots at 45° intervals are 1/16 in. wide, and must intersect exactly at the common centre of the circles. Three very small steel points let in near the edge are a convenience in holding the instrument in position on the paper, but are not essential.

To use this instrument a small circle is drawn on the map with a bow compass. This forms the base circle of the wind rose, and is made exactly the size of one of the circles on the instrument, which is then centred over it with one of the slots pointing north on the map. The wind rose is then quickly drawn by using the sides of the slots as rulers and the circles as a scale. If the slots are about 1/16 in. wide, it is possible to draw a single line down the middle of the slot by inclining the pencil, or a double line by keeping the pencil close to the side of the slot. A sixteen-point rose may be drawn by first drawing the eight principal directions, then turning the instrument through $22\frac{1}{2}°$ in either direction and drawing the other eight.

An eight-point rose, showing one of the usual conventions for wind strengths, is shown in the figure as if just drawn, with the instrument still over it.

W. E. Knowles Middleton.

Meteorological Office, Toronto. November 15th, 1933.

The Parhelic Circle

The white horizontal circle associated at times with halos is seen so rarely in Australia that the following description by Mr. W. B. Lloyd of Stanhope, northern Victoria, may be worth recording. " At 9.30 p.m., August 9th, the sky was fairly clear —perhaps a slight haze, but all the larger stars bright, the only cloud being a bank well down on the western horizon and another, low in the south-east. There was no wind. A large and well-defined circle of opaque light formed a perfect circle round the zenith at the angle of altitude of the moon, which appeared set in the ring like a stone in a finger ring. With the moon as centre a segment of lunar halo, showing faint prismatic colours, mostly green and red, intersected the great white circle, terminating at each intersection in a patch of white light resembling a great nebula. It was a beautiful and remarkable sight and lasted till 9h. 42m. when some light cirrus cloud drifted across the moon, the circle faded out, as did the segment of halo and the moon remained shining transparently in the midst of a rather highly coloured circular patch of light."

On the morning of the 9th at Melbourne aeroplane observations showed that temperatures varied from 22° to −1° F.

between 10,000 and 16,000 feet. Observations were not continued above 16,000 ft. In the afternoon winds from 7,500 to 11,000 ft. were less than 3 m.p.h., but from 11,000 to 13,000 ft. (the top of the ascent) they gradually increased to 10 m.p.h. The balloon was passing through fragments of clouds from 7,000 to 13,000 ft. and the sky was mostly covered with alto-cumulus in two layers. The lower layer was moving very slowly from east at about 10,000 ft., the higher from west-north-west at 13,000 ft. At the time a narrow anticyclone with a north-south axis, bordered by two vigorous cyclones, lay over Victoria, and the axis passed the meridians of Melbourne and Stanhope in the evening, so that the quiet conditions were if anything likely to be accentuated then.

Melbourne is nearly a hundred miles from Stanhope, but the circumstances indicated the considerable probability of still air and possibly ice crystals at a relatively low elevation over Stanhope on the night in question. Even at ordinary cirrus level the likelihood of low velocities was great, judging from experience of balloon ascents in similar meteorological situations.

Wood in his "Physical Optics" states that the white horizontal circle, mock moons, and other halo phenomena except the two halos of 22° and 46° require still air for their production. Is this distinction generally accepted? It does not seem to receive much emphasis in meteorological text books.

In his letter and sketch the observer places the mock moons on the halo, although the altitude of the moon was 45° at the time.

H. M. TRELOAR.

Central Weather Bureau, Melbourne. October 11th, 1933.

Sunspots and Sunshine

I regret that the passages quoted by Mr. J. B. C. Kershaw in the December issue of this magazine from a newspaper article which appeared under my signature last June should have misled him as to the dates of recent minima of the sunspot cycle. I may, however, be permitted to point out that "approach" is not ordinarily regarded as a synonym for "arrival." The former word is admittedly somewhat vague, but it was chosen in order to avoid the use of such a cumbersome expression as "either one year, two years, or three years in advance of the minimum." The argument was that since the best astronomical opinion placed the end of the present sunspot cycle in about 1934, and since no particularly fine or hot summer had come our way in 1931 or 1932, such a season would probably arrive in 1933.

E. L. HAWKE.

Caenwood, Rickmansworth, Herts. January 1st, 1934.

A Brilliant Solar Corona

Mr. Moon's reference to a brilliant lunar corona on October 31st at Hastings, reminds me that I observed a striking solar corona in London between 12 and 1 p.m. on December 16th.

In this case likewise there were three distinct rings which were very broad, red outside and green inside. The general complexion of the sky at the time was a misty orange, and the sheet of cloud producing the corona seemed to be a cross between cirro-stratus and cirro-cumulus, changing later definitely to cirro- or alto-cumulus. This indication that the cloud sheet was composed of water particles and not ice-crystals, I took to be a hint that the cold weather might be about to soften—which, as a matter of fact, it did, though I should never place much reliance on such a prognostic.

Unlike halos, coronæ round the sun are not very common, and are probably more likely to be seen in December than in other months on account of the feeble sunlight.

L. C. W. Bonacina.

35, *Parliament Hill, London, N.W.3. December 27th*, 1933.

NOTES AND QUERIES

Averages of Temperature for the British Isles*

The revised collection of average values of temperature for stations in the British Isles, which has just been issued under the above title to replace the figures for temperature in Section I of "The Book of Normals," forms a new departure in the method of preparing averages for this country, and demands more than a cursory mention in this magazine.

The first section of "The Book of Normals," published in 1919, contained monthly normals of temperature, rainfall and sunshine for the period 1881 to 1915. In accordance with the customary practice in the Meteorological Office at that time, the period of 35 years was chosen as being about the length of the Brückner cycle, and the averages for stations which had not been in existence during the whole period were "corrected" by comparison with neighbouring stations. At that time the hours of observation had remained unaltered at most stations since 1881, the chief exception being the change of the morning hour at telegraphic stations from 8h. to 7h., which occurred at the end of June, 1908, and the observations of maximum and minimum temperature always referred to the full interval of 24 hours, so that the task of compiling the normals of temperature was comparatively straightforward.

In 1921 a new conception was introduced into climatology—that of "day maximum" and "night minimum"; by which at a number of stations the temperature to be recorded as the

*Averages of temperature of the British Isles for periods ending 1930. London, Meteor. Office (M.O. 364), 1933, pp. 47, price 9d.

maximum on any day was the highest during the daylight hours, generally 7h. to 18h., and the recorded minimum was the lowest during the night hours, generally 18h. to 7h. On most days the day maximum and night minimum are the same as the 24-hour extremes, but in our variable climate there are many exceptions, and the extremes may occur at any hour. At "telegraphic reporting stations" the new conception has been maintained to the present day, but "health resorts" reverted to the earlier practice in 1926, while many stations have continued to use 24-hour extremes throughout.

The two sets of readings are not comparable, and in order to prepare corrected long series extensive calculations would have been required. Preliminary investigations had shown moreover that such "corrected" normals are subject to uncertainties which limit their value. Hence the decision was taken to base the new averages only on those observations which were made in the form in use at present, although this meant limiting the period available for many stations to the ten years since 1921. Thus the standard 35-year period was abandoned, with all the perilous extrapolations which it involved, and the new averages are based only on temperatures which have been directly observed. The experience gained in preparing the annual volumes of the *Réseau Mondial* has in fact shown that direct averages are preferable to "normals" artificially reduced to a standard period.

Having abandoned the 35-year standard, it would at first sight seem natural to give for each station figures for as long a period as possible. An objection to this course is that few stations exist for a long period without some change of site or surroundings. Giving due weight to this and other considerations it was decided that the averages of temperature adopted for current use in the *Monthly and Weekly Weather Reports* should in future refer to a maximum period of 30 years, and that they should be revised every five years. Thus for any station the averages will never exceed a period of 30 years, and will always be reasonably comparable with the existing site and surroundings. The present book of averages thus refers to the 30 years 1901 to 1930. This has a further advantage; about the end of the nineteenth century there was an appreciable change in the winter climate of England. This is clearly shown in the attached table, where some figures for the months of December to February, 1901-30, from the new averages are compared with those for 1871-1900 from "Temperature Tables for the British Islands."

	1901-30.			1871-1900.		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean
	° F.	° F.	° F.	° F.	° F.	° F.
Kew Observatory	45·4	36·2	40·8	43·7	34·7	39·2
Oxford	45·3	35·2	40·3	43·9	33·9	38·9

Thus the limitation of the averages to the present century gives a real gain in uniformity, which goes far towards counter-balancing the defect that the averages for different stations may refer to different periods. Because of the latter limitation they are described in the introduction as "averages" and not as "normals."

The new publication contains averages for each month and for the year of daily maximum, daily minimum and "mean" temperature (the arithmetical average of the daily maximum and minimum) for 244 stations. Of these, 151 are in England, the Isle of Man and the Channel Islands, 13 are in Wales, 22 in Ireland and 56 in Scotland, the remaining two being Gibraltar and Malta. They show that the highest mean temperature for the year is found in Penzance (52·5° F.), Jersey (52.4° F.), and Scilly (52·3° F.), and the lowest at high-level Scottish stations such as Braemar (43·1° F.), where the average daily minimum is below freezing point from November to March. The highest summer temperatures are found in the London area.

A similar publication giving averages of sunshine for the period 1901 to 1930 is in course of preparation. The new averages for both elements were adopted for the purpose of the *Monthly Weather Report* from January 1st, 1934.

The Rainfall of 1933

The rainfall of 1933 over the British Isles as a whole was 81 per cent. of the average. Thus the remarkable run of ten wet years, which commenced in 1923, has been broken. 1933 ranks as the driest year since 1870, with but one exception, viz. 1887 with 77 per cent., being slightly drier than 1921 with 82 per cent. Provisional estimates of the general rainfall for 1933 are given below, both in actual inches and as percentages of the average, together with similar values for the dry years 1921 and 1887.

	1933.		1921.		1887.	
	in.	%	*in.*	%	*in.*	%
England and Wales ...	29·3	83	24·7	70	26·3	74
Scotland	39·9	79	49·8	99	40·2	80
Ireland	33·2	77	38·1	88	33·2	77
British Isles	33·5	81	34·0	82	31·7	77

It will be seen that over England and Wales 1933 was not as dry as 1921, but since 1870 the only other comparable years were 1893 with 83 per cent. and 1870 with 82 per cent. Over Scotland 1933 was drier than any year since before 1870, although 1887 and 1870 both gave 80 per cent. Over Ireland 1933 ranks with 1887 as giving the least rainfall since before

1870. The rainfall of 1933 was remarkable in that each country experienced a large deficiency, so that the distribution resembled 1887 rather than 1921, when the deficiency was most marked in the south-eastern half of England and Wales.

General values for each month are set out in the table below, both as percentages of the average for the period 1881 to 1915 and in actual inches of rainfall:—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	%	%	%	%	%	%	%	%	%	%	%	%
England & Wales	93	160	119	70	97	92	82	38	94	103	59	29
Scotland	103	123	64	95	69	85	108	75	41	107	67	32
Ireland	90	109	99	65	114	94	90	58	45	83	49	49
British Isles ..	95	140	101	75	94	91	90	51	70	100	59	34
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
England & Wales	2·8	4·1	3·2	1·5	2·2	2·2	2·3	1·3	2·4	4·1	2·1	1·1
Scotland	5·1	5·1	2·6	2·8	2·1	2·4	4·1	3·4	1·6	5·2	3·6	1·9
Ireland	3·7	3·9	3·3	1·8	3·1	2·7	3·0	2·4	1·4	3·4	2·1	2·4
British Isles ..	3·6	4·6	3·2	1·9	2·4	2·4	2·9	2·0	2·2	4·2	2·5	1·6

February alone gave an appreciable excess of rainfall over the British Isles generally, but the total amount from January to July was only 2 in. short of the average. The deficiencies were outstanding, however, only in August, November and December. August, 1933, was considerably wetter than August, 1880, with 1·5 in. and only a little drier than August, 1932, with 2·3 in. November, 1933, was also appreciably wetter than that of 1896 with 1·8 in. December, 1933, was just drier than that of 1926 with 1·7 in., which had previously been the driest December since before 1870.

The rainfall during 1933 was remarkable for the long sequence of nine consecutive months in none of which was the average amount exceeded. The total rainfall for November and December, 1933, of 4·1 in. was less than that during any similar period back to 1870, the previous driest November to December being that of 1879 with 4·2 in. The total rainfall during the nine months April to December, 1933, of 22·1 in. was also less than that of any similar period back to 1870, the next driest April to December being those of 1921 and 1887, both with 24·1 in.

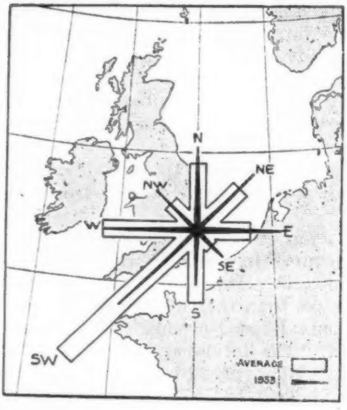
The total rainfall for 1933 exceeded the average, for the standard period 1881 to 1915, to the east of the Pennines from Sunderland to Goole and in parts of Hampshire. No part of England appears to have received more than 110 per cent. of the average, and no part of Wales, Scotland or Ireland as

much as the average. Over England and Wales less than 70 per cent. occurred over a large area including London, Croydon, Harpenden and Southminster, and also in the neighbourhood of Bideford, the Cheshire Plain and Plinlimmon. More than 90 per cent. occurred over a large area between Newcastle and Retford, stretching as far west as Barnard Castle, Bradford and Barnsley, in parts of Wiltshire, Hampshire, south Devon and Cornwall, and at Birmingham and Lowestoft. Over Scotland the percentages varied from rather more than 90 per cent. in Aberdeenshire and western Argyllshire to about 70 per cent. at Perth, Girvan, St. Andrews, Lairg and Stornoway. Over Ireland the percentages varied from rather more than 85 per cent. in the west of Galway and Mayo and near Dublin and Wexford, to less than 70 per cent. over large areas in Londonderry, Armagh, Limerick and the south-west of Cork.

J. GLASSPOOLE.

Lack of SW. Winds at Kew

With reference to the interesting paper by Dr. Glasspoole and Mr. Andrew summarised on p. 283, the comparative lack of SW. winds during the period May to November, 1933, deserves notice. To me this deficiency of genial winds has been apparent, and I find that the frequency of SW. winds at Kew during this period has been only 18 per cent. compared with a normal of about 30 per cent. The accompanying wind rose illustrates the point: instead of the usual Kew wind rose with the long tail to south-west a more general distribution is shown. This fits in well with the opening out of the isobars referred to in Dr. Brooks' section on pressure conditions.



R. M. POULTER.

Weather Proverbs

There are many weather proverbs relating to animals, and in this connexion the following may be of interest.

To an account of a severe storm recorded in the log of one of H.M. ships in the Persian Gulf the following note is

appended :—" The first indication of the approach of the storm observed was the behaviour of the ship's cats. For the previous week they had been very lazy and sleepy, but about twelve hours before the storm, they went quite mad, rushing wildly about and biting people's feet."

Review

The effect of topography on the direction and velocity of wind. II. Geophys. Mag., Tokyo, 7, 1933, p. 9. *Direction and velocity of wind in the vicinity of a wind tower.* Ibid. 7, 1933, p. 19. *On the influence of topography on the micro-barometric observations.* Ibid. 5, 1932, p. 223. By H. Arakawa.

In the first two of these three papers H. Arakawa discusses the flow of air in the neighbourhood of obstacles and uses a modification of Lamb's analysis to obtain the stream functions for a mountain of the shape of a semi-ellipsoid rising from a flat plane. In the second he discusses a somewhat similar problem with a rectangular tower. The results he derives are concisely shown by wind roses. In the case of roses in which the wind from each direction is of equal velocity over the unobstructed plane, the roses near the top of the mountain or the tower are deformed in such a way that the strongest winds are at right angles to the major axis of the ellipsoid or the longer side of the rectangle. A similar effect is found in the case of roses where the frequency is the same from each direction over the unobstructed plane. Such a result is what would be expected in the case of an ideal fluid, and the value of the papers is to be measured by the extent to which numerical figures can be given which are applicable to the actual facts of wind blowing over the earth. One feels that the author is dealing rather with the realms of the (mathematical) Gods on High Olympus " above the smoke and stir of this dim spot, that men call Earth," for turbulence must radically alter the numerical results. The author is fully aware of this, and in what is probably the most valuable part of the first of these papers he discusses the effect which a vortex in the rear of a semi-cylindrical mountain would have in altering the distribution of wind over the ridge. The effect of such a vortex is to modify the distortion of both the velocity and direction roses from the distribution over the unobstructed plane.

In the third paper Arakawa draws attention to the remarkable behaviour of the microbarograph at the observatory on Mt. Huzi, which shows large oscillations when the microbarograph at Tokyo shows very little fluctuation. In part he ascribes these to the oscillations of air set up in the crater of the moun-

tain, but he goes on to consider how far the presence of a mountain may magnify the wave motion in a surface of discontinuity lying above it. He concludes that at the top of the mountain the pressure differences due to the waves should be considerably enhanced. This leads him to a brief review of the association between microbaric oscillations and the presence of discontinuities. To detect the discontinuity he uses marked changes of upper winds, as disclosed by pilot balloons, rainfall and the presence of wave cloud and finds the agreement is close. It would certainly seem that in Japan the microbarograph may, under suitable conditions, be of considerable use in detecting the arrival of a front, especially above a mountain station, and it is not unnatural to ask whether the instrument could not be used in this way in the British Isles. No very serious attempt appears to have been made in this country to correlate microbarograms with synoptic charts, though it was Goldie* who first pointed out the association of the wave motion at discontinuities and microbarographic oscillations.

In 1929 D. E. Davies† found less close relationship between atmospheric oscillations and rainfall than Fujiwhara and Kanagawa‡ had done in Japan. That may, however, be explained by the difference in type of front that is found over Japan and England. Over the former depressions are comparatively young, and probably few fronts do not give rain, but in England, when the decayed fronts of dead Atlantic depressions are being carried over, there are frequent occasions when a discontinuity may be present without giving rain.

It would seem that further investigation in this country might lead to some interesting and practical results.

C. S. Durst.

Books Received

Jaarboek, Koninklijk Nederlandsch Meteorologisch Instituut, 1931. A. Meteorologie, B. Aard-Magnetisme (Nos. 97 and 98). Utrecht, 1932.

News in Brief

Dr. and Mrs. G. C. Simpson invited the staff of the Meteorological Office to a dance at Australia House on December 19th. Over 200 members of the staff and guests attended and spent a very enjoyable evening. An interesting interlude was provided by Mr. J. M. Stagg and Mr. W. A. Grinsted, who described and illustrated their experiences at Fort Rae during the Polar Year.

* A. H. R. Goldie. *Q.J.R. Meteor. Soc.* **51**, 1925, p. 239.
† *Meteor. Mag.*, **64**, p. 191.
‡ *Geophys. Mag.*, **1**, p. 304.

The Weather of December, 1933

Pressure was above normal over Spitsbergen, Iceland, Europe from the extreme north to a line joining Dijon and Bucharest, most of the North Atlantic including the Azores and Bermudas, Florida, California, north central United States, Canada and Alaska, the greatest excesses being 17·3mb. at Lerwick and 13·2mb. at Kodiak. Pressure was below normal in a belt extending from Greenland across Newfoundland and Nova Scotia to the United States and also over southern Europe, the greatest deficits being 6·7mb. at Ekaterinburg, 5·6mb. at Algiers and 4·5mb. at Julianehaab. Temperature was above normal in Spitsbergen and northern Scandinavia but below normal in the British Isles, southern Scandinavia and central and southern Europe. Precipitation was generally deficient except in northern Norway and the mountainous parts of Sweden. In west Svealand and west Götaland it was only about 10 per cent. of the normal.

The weather of December over the British Isles was persistently cold, except in the extreme north and unusually dry with much fog in England and south Scotland, while pressure was much above normal (see p. 279). At Eskdalemuir and Gorleston it was the driest December since records began in 1910 and 1871, respectively. Sunshine records were variable, though usually deficient in the east and in excess in the west. On the 1st and 2nd a trough of low pressure moved across the western districts with gales in the north and west and heavy rain locally, 2·17 in. fell at Fofanny (Co. Down) and 2·10 in. at Holne (Devon), on the 1st. Snow was reported in Wales and Scotland. On the 2nd the anticyclone over Scandinavia spread westwards across the country and the weather became mainly dry and cold with E. to SE. winds, except in the extreme north-west where milder conditions and scattered showers were experienced. On the 6th and 7th fog was widespread in England and some low maximum temperatures were recorded on the 6th, 23° F. at Manchester. On the 7th a shallow trough of low pressure passing across the country caused drizzle generally. From the 8th-11th the influence of the anticyclone again predominated as it moved westwards to the Atlantic and very cold, cloudy but mainly dry conditions were experienced generally but with snow showers locally. On the 11th and 12th a depression passed from Iceland to the Bay of Biscay and rain, sleet or snow were experienced generally both then and on the 13th, when this depression developed considerably over France, giving fresh to strong E. to NE. winds over southern England with, on the 13th and 14th, gales locally. On the 13th, however, the anticyclone extending from the Azores to Iceland began to move south and by the 15th had spread over the whole of the British Isles, displacing this depression. Cold quiet anticyclonic conditions were experienced from then until the 21st with widespread fog on the 17th and 19th-21st in England and south Scotland.

Conditions throughout this period were finer in the west and north. On the 21st a low-pressure area moving north-eastwards approached our western seaboard, and in the west and north the winds became S—SW., fresh to strong with gales locally, and the weather mild and unsettled until the 26th. Meanwhile the south-eastern districts remained under the influence of the anticyclone over France with dry, mainly dull, conditions and much local mist or fog. On the 27th a depression off north-west Ireland moved south-east and from then until the 30th, rain or drizzle accompanied by much mist or fog in England and south Scotland occurred generally, with heavier rain in the west on the 27th, 1·30 in. at Abbey Leix (Co. Leix) and at Broadford (Co. Clare), and snow or sleet at a few places—gales occurred locally in the south-west on the 28th. On the 31st there was a renewal of anticyclonic conditions, but with a continuance of the mist or fog in England and south Scotland and with drizzle in the west. Among the lowest temperatures recorded in the month were 15° F. in the screen at Rhayader on the 6th and 13° F. at Dalwhinnie on the 10th and 14th, and on the ground 7° F. at Dalwhinnie on the 10th and 11th, and 9° F. at Collumpton on the 10th. The distribution of bright sunshine for the month was as follows :—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway	31	+ 8	Liverpool	31	—12
Aberdeen	39	+ 3	Ross-on-Wye	45	+ 3
Dublin	29	—19	Falmouth	57	+ 2
Birr Castle	51	+ 8	Gorleston	41	— 4
Valentia	66	+25	Kew	19	—18

The special message from Brazil states that the rainfall in the northern regions was irregular in distribution with an average 0·12 in. above normal, in the central regions generally plentiful with 2·01 in. above normal, and in the southern regions scarce with 0·39 in. below normal. Six anticyclones passed across the country. The temperature was abnormally low. The crops generally were in good condition, except in Rio Grande, where they were suffering from lack of rain during the last decade. The cereals were still affected by locust. At Rio de Janeiro pressure was 0·5 mb. below normal and temperature 2·0° F. below normal.

Miscellaneous notes on weather abroad culled from various sources. Fifteen degrees of frost were registered at Braila (Roumania) during the nights of the 2nd-3rd and 3rd-4th. During the severe storm over the southern North Sea on the 3rd and 4th two lightships went adrift off the Belgian and French coasts. By the 6th it was reported from Leningrad that solid ice had formed as far as Kronstad, but that a canal was being kept open by icebreakers. On the 9th the inland canal and waterway at Antwerp were frozen and navigation closed. On the 12th navigation closed at Yxpila, Jacobstad and Kristinestad in the

Baltic. Severe weather with very low temperatures and storms prevailed over the greater part of Europe about the middle of the month. Heavy snow occurred in northern Italy and along the Riviera; Venice lay under about 3 ft. of snow on the 14th, but on the 15th the tide rose 4 ft. above the normal and the city was flooded. On the 17th a temperature of $-4°$ F. was recorded at Nyons (Drôme, south France), and the railway line from Paris to Marseilles was blocked by snow over 9 ft. deep near Alais, the cold being intensified by the mistral. Ski-ing conditions were excellent in Switzerland during this time. There was a marked rise in temperature over France about the 20th, and temperature was also less severe in Switzerland over Christmas, but in Austria snowdrifts and avalanches caused dislocation of traffic. Christmas was mild in Iceland. Towards the end of the month heavy snow was again experienced in Piedmont and Lombardy and small snowfalls occurred in Switzerland. Navigation closed at Vasa, Finland, on the 30th. (*The Times*, December 5th-January 2nd.)

The heavy rains in north Morocco early in the month caused serious floods about the 12th. Severe wintry weather followed from about the 14th-20th with heavy snow in the neighbourhood of Fez. The mail train from Bloemfontein to Durban was derailed on the 15th 33 miles from Bloemfontein, owing to a subsidence in the line caused by the heavy rains. Extensive storms followed by floods did much damage in South Africa towards the end of the month, the railways being washed away at several points. (*The Times*, December 13th-30th.)

Severe cold and blizzards were experienced in Canada during the latter part of the month, a temperature of $-66°$ F. being recorded at Mayo, Yukon, on the 29th. On the 31st, however, there was a change to mild weather with sleet and rain. Temperature was considerably above the average over many districts of the United States during the greater part of the month. A heavy snowstorm, however, began in New York on Christmas night, and from then onwards severe cold and snowstorms occurred generally over the whole country until the temperature began to rise on the 31st—100 people died of the cold. Precipitation was irregular in distribution in the United States. Widespread floods followed heavy rains in California on the 30th and 31st; 66 people are known to have been killed or injured. (The *Times*, December 27th-January 3rd, and *Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin and Toronto, Canadian Daily Weather Report.*)

General Rainfall for December, 1933

England and Wales ...	29	per cent of the average 1881-1915.
Scotland	32	
Ireland	49	
British Isles	34	

Rainfall: December, 1933: England and Wales.

Co.	Station	In.	Per-cent. of Av.	Co.	Station	In.	Per-cent. of Av.
Lond	Camden Square	·36	15	*Leics.*	Thornton Reservoir	·49	18
Kent	Tenterden, Ashenden	·57	18	,,	Belvoir Castle	·35	14
,,	Folkestone, Boro. San.	·83	...	*Rut*	Ridlington	·35	14
,,	St. Peter's, Hildersham	...	...	*Lincs*	Boston, Skirbeck	·67	31
,,	Eden'bdg., Falconhurst	·62	19	,,	Cranwell Aerodrome	·37	17
,,	Sevenoaks, Speldhurst	·50	...	,,	Skegness, Marine Gdns	·56	25
Sus	Compton, Compton Ho.	·92	22	,,	Louth, Westgate	·68	24
,,	Patching Farm	1·25	37	,,	Brigg, Wrawby St.	·33	...
,,	Eastbourne, Wil. Sq.	1·31	35	*Notts*	Worksop, Hodsock	·36	15
,,	Heathfield, Barklye	1·08	29	*Derby*	Derby, L. M. & S. Rly.	·32	12
Hants	Ventnor, Roy. Nat. Hos.	1·00	30	,,	Buxton, Terr. Slopes	·52	9
,,	Fordingbridge, Oaklnds	1·01	25	*Ches*	Runcorn, Weston Pt	·76	24
,,	Ovington Rectory	·64	16	*Lancs*	Manchester, Whit Pk.	·44	14
,,	Sherborne St. John	·45	14	,,	Stonyhurst College	·73	15
Herts	Welwyn Garden City	·51	21	,,	Southport, Hesketh Pk	·83	26
Bucks	Slough, Upton	·48	19	,,	Lancaster, Greg Obsy.	·70	16
,,	H. Wycombe, Flackwell	·49	16	*Yorks*	Wath-upon-Dearne	·25	11
Oxf	Oxford, Mag. College	·24	10	,,	Wakefield, Clarence Pk.	·52	21
Nor	Pitsford, Sedgebrook	...	...	,,	Oughtershaw Hall	1·00	...
,,	Oundle	·39	...	,,	Wetherby, Ribston H.	·77	31
Beds	Woburn, Exptl. Farm.	·38	16	,,	Hull, Pearson Park	·51	21
Cam	Cambridge, Bot. Gdns.	·28	15	,,	Holme-on-Spalding	·68	28
Essex	Chelmsford, County Lab	·55	25	,,	West Witton, Ivy Ho.	·73	20
,,	Lexden Hill House	·45	...	,,	Felixkirk, Mt. St. John	·99	41
Suff	Haughley House	·45	...	,,	York, Museum Gdns.	·52	23
,,	Campsea Ashe	·79	34	,,	Pickering, Hungate	1·03	41
,,	Lowestoft Sec. School	·68	29	,,	Scarborough	·87	37
,,	Bury St.Ed. Westley H.	·54	22	,,	Middlesbrough	1·61	83
Norf	Wells, Holkham Hall	·74	36	,,	Baldersdale, Hury Res.	·80	22
Wilts	Devizes, Highclere	·63	21	*Durh*	Ushaw College	2·00	80
,,	Calne, Castleway	·43	14	*Nor*	Newcastle, Town Moor	1·37	57
Dor	Evershot, Melbury Ho.	1·03	20	,,	Bellingham. Highgreen	1·08	30
,,	Weymouth, Westham	1·02	29	,,	Lilburn Tower Gdns	2·04	78
,,	Shaftesbury, Abbey Ho.	·75	21	*Cumb*	Carlisle, Scaleby Hall	·85	26
Devon	Plymouth, The Hoe	2·43	49	,,	Borrowdale. Seathwaite	4·00	26
,,	Holne, Church Pk. Cott.	3·33	39	,,	Borrowdale, Moraine	2·04	17
,,	Teignmouth, Den Gdns.	2·83	70	,,	Keswick, High Hill	·41	6
,,	Cullompton	1·65	38	*West*	Appleby, Castle Bank	1·15	29
,,	Sidmouth, Sidmount	2·72	69	*Mon*	Abergavenny, Larchf'd	1·65	37
,,	Barnstaple, N. Dev. Ath	1·93	44	*Glam*	Ystalyfera, Wern Ho.	2·06	25
,,	Dartm'r, Cranmere Pool	2·70	...	,,	Cardiff, Ely P. Stn.	2·05	40
,,	Okehampton, Uplands	2·71	38	,,	Treherbert, Tynywaun	3·17	...
Corn	Redruth, Trewirgie	2·71	43	*Carm*	Carmarthen Friary	1·42	25
,,	Penzance, Morrab Gdn.	2·48	44	*Pemb*	Haverfordwest, School	2·34	41
,,	St. Austell, Trevarna	3·93	65	*Card*	Aberystwyth	1·53	...
Soms	Chewton Mendip	1·11	21	*Rad*	Birm W.W. Tyrmynydd	1·92	23
,,	Long Ashton	1·43	37	*Mont*	Lake Vyrnwy	1.77	26
,,	Street, Millfield	·82	24	*Flint*	Sealand Aerodrome	·51	20
Glos	Blockley	·39	...	*Mer*	Dolgelley, Bontddu	2·26	33
,,	Cirencester, Gwynfa	·56	17	*Carn*	Llandudno	1·28	44
Here	Ross, Birchlea	·77	26	,,	Snowdon, L. Llydaw 9	2·82	...
Salop	Church Stretton	·67	20	*Ang*	Holyhead, Salt Island	2·33	56
,,	Shifnal, Hatton Grange	·52	20	,,	Lligwy	1·48	...
Staffs	Market Drayt'n, Old Sp.	·40	14	*Isle of Man*			
Worc	Ombersley, Holt Lock	·42	16		Douglas, Boro' Cem.	2·08	42
War	Alcester, Ragley Hall	·48	20	*Guernsey*			
,,	Birminghm. Edgbaston	·49	18		St. PeterP't. Grange Rd	2·34	57

Rainfall: December, 1933: Scotland and Ireland.

Co.	Station	In.	Per cent. of Av.	Co.	Station	In.	Per cent. of Av.
Wig	Pt. William, Monreith	1·87	41	*Suth*	Melvich	·97	23
,,	New Luce School	2·79	50	,,	Loch More, Achfary	2·35	25
Kirk	Dalry, Glendarroch	2·02	28	*Caith*	Wick	1·09	35
,,	Carsphairn, Shiel	2·29	25	*Ork*	Deerness	1·61	38
Dumf	Dumfries, Crichton, R.I	·56	14	*Shet*	Lerwick	1·93	40
,,	Eskdalemuir Obs.	1·31	19	*Cork*	Caheragh Rectory	2·38	...
Roxb	Branxholm	·83	23	,,	Dunmanway Rectory	2·72	34
Selk	Ettrick Manse	·97	16	,,	Cork, University Coll.	1·66	32
Peeb	West Linton	·99	...	,,	Ballinacurra	1·45	28
Berw	Marchmont House	1·26	45	*Kerry*	Valentia Obsy	2·98	45
E.Lot	North Berwick Res.	1·42	66	,,	Gearhameen	4·10	33
Midl	Edinburgh, Roy. Obs.	·79	34	,,	Darrynane Abbey	2·49	42
Lan	Auchtyfardle	·66	...	*Wat*	Waterford, Gortmore	2·33	51
Ayr	Kilmarnock, Kay Pk.	1·62	...	*Tip*	Nenagh, Cas. Lough	1·84	40
,,	Girvan, Pinmore	2·15	36	,,	Roscrea, Timoney Park	1·33	...
Renf	Glasgow, Queen's Pk.	·64	15	,,	Cashel, Ballinamona	1·94	45
,,	Greenock, Prospect H.	1·53	19	*Lim*	Foynes, Coolnanes	1·45	31
Bute	Rothesay, Ardencraig.	2·16	...	,,	Castleconnel Rec.	2·43	...
,,	Dougarie Lodge	2·63	...	*Clare*	Inagh, Mount Callan	2·80	...
Arg	Ardgour House	4·12	...	,,	Broadford, Hurdlest'n.	2·45	...
,,	Glen Etive	...	...	*Wexf*	Gorey, Courtown Ho.	2·51	66
,,	Oban	2·96	...	*Wick*	Rathnew, Clonmannon	3·01	...
,,	Poltalloch	3·10	49	*Carl*	Hacketstown Rectory	2·50	61
,,	Inveraray Castle	4·45	45	*Leix*	Blandsfort House	2·56	70
,,	Islay, Eallabus	3·43	58	,,	Mountmellick	2·15	...
,,	Mull, Benmore	...	...	*Offaly*	Birr Castle	1·93	59
,,	Tiree	2·54	49	*Dublin*	Dublin, FitzWm. Sq.	1·48	60
Kinr	Loch Leven Sluice	1·12	28	,,	Balbriggan, Ardgillan.	1·98	69
Perth	Loch Dhu	1·95	18	*Meath*	Beauparc, St. Cloud	2·20	...
,,	Balquhidder, Stronvar	1·65	...	,,	Kells, Headfort	1·84	48
,,	Crieff, Strathearn Hyd.	·91	20	*W.M*	Moate, Coolatore	2·74	...
,,	Blair Castle Gardens	·73	19	,,	Mullingar, Belvedere	2·63	71
Angus	Kettins School	1·22	37	*Long*	Castle Forbes Gdns.	2·22	56
,,	Pearsie House	1·92	...	*Gal*	Galway, Grammar Sch.	1·75	...
,,	Montrose, Sunnyside	1·54	55	,,	Ballynahinch Castle	3·26	43
Aber	Braemar, Bank	1·14	39	,,	Ahascragh, Clonbrock.	1·79	38
,,	Logie Coldstone Sch.	1·24	44	*Mayo*	Blacksod Point	3·21	52
,,	Aberdeen, King's Coll.	1·91	59	,,	Mallaranny	3·32	...
,,	Fyvie Castle	2·02	59	,,	Westport House	2·08	36
Moray	Gordon Castle	·45	17	,,	Delphi Lodge	5·07	42
,,	Grantown-on-Spey	...	...	*Sligo*	Markree Obsy	1·83	38
Nairn	Nairn	·28	13	*Cavan*	Crossdoney, Kevit Cas.	2·34	...
Inv's	Ben Alder Lodge	·75	...	*Ferm*	Enniskillen, Portora	...	...
,,	Kingussie, The Birches	·37	...	*Arm*	Armagh Obsy	1·64	52
,,	Inverness, Culduthel R.	·25	...	*Down*	Fofanny Reservoir	4·99	...
,,	Loch Quoich, Loan	15·30	...	,,	Seaforde	2·03	49
,,	Glenquoich	2·76	18	,,	Donaghadee, C. Stn.	2·48	78
,,	Arisaig, Faire-na-Sguir	2·54	...	,,	Banbridge, Milltown	1·41	49
,,	Fort William, Glasdrum	2·03	...	*Antr*	Belfast, Cavehill Rd.	2·16	...
,,	Skye, Dunvegan	3·67	...	,,	Aldergrove Aerodrome	1·61	47
,,	Barra, Skallary	2·72	...	,,	Ballymena, Harryville	2·62	59
R & C	Alness, Ardross Castle	·41	10	*Lon*	Garvagh, Moneydig	2·38	...
,,	Ullapool	·69	11	,,	Londonderry, Creggan	2·31	53
,,	Achnashellach	1·65	16	*Tyr*	Omagh, Edenfel	2·38	56
,,	Stornoway	1·59	25	*Don*	Malin Head	1·83	...
Suth	Lairg	·83	21	,,	Milford, The Manse	2·29	49
,,	Tongue	·84	17	,,	Killybegs, Rockmoun.	...	...

Climatological Table for the British Empire, July, 1933

STATIONS	PRESSURE Mean of Day M.S.L. mb.	PRESSURE Diff. from Normal mb	TEMPERATURE Absolute Max. °F.	TEMPERATURE Absolute Min. °F.	TEMPERATURE Mean Values Max. °F.	TEMPERATURE Mean Values Min. °F.	TEMPERATURE Mean Values ½ max. and min. °F.	TEMPERATURE Mean Values Diff. from Normal °F	TEMPERATURE Mean Wet Bulb °F.	Relative Humidity %	Mean Cloud Am'nt 0—10	PRECIPITATION Am'nt in.	PRECIPITATION Diff. from Normal in.	PRECIPITATION Days	BRIGHT SUNSHINE Hours per day	BRIGHT SUNSHINE Percentage of possible
London, Kew Obsy.	1017·8	+ 2·0	88	52	75·9	58·1	67·0	+ 4·3	59·2	80	5·5	1·74	− 0·43	9	7·9	49
Gibraltar	1017·9	+ 1·1	90	61	82·3	66·6	74·5	− 0·3	65·5	81	3·7	0·00	− 0·03	0	..	..
Malta	1017·4	+ 2·7	94	66	82·7	70·4	76·5	− 1·8	68·7	68	1·4	0·02	− 0·03	1	12·5	88
St. Helena	1017·2	+ 0·6	65	53	60·4	55·0	57·7	− 0·8	55·6	95	8·7	4·78	..	26	..	..
Freetown, Sierra Leone	1015·1	+ 2·4	87	65	82·5	69·9	76·2	− 2·4	74·8	90	8·2	31·76	− 3·82	26	..	..
Lagos, Nigeria	1013·9	+ 0·7	86	72	82·7	74·7	78·7	+ 0·7	74·8	90	9·4	19·49	+ 8·99	25	3·0	24
Kaduna, Nigeria	1014·2	− 0·7	89	65	84·7	69·1	76·9	+ 3·3	71·6	87	8·5	8·63	− 1·99	22	6·0	48
Zomba, Nyasaland	1018·2	− 0·3	85	45	73·3	52·2	62·7	+ 0·7	56·3	64	4·7	0·22	− 0·13	3	..	..
Salisbury, Rhodesia	1021·3	− 0·2	78	35	71·0	43·9	57·5	+ 1·4	49·7	56	0·8	0·00	− 0·03	0	9·4	84
Cape Town	1019·8	− 1·5	80	36	61·3	46·8	54·1	− 0·6	47·0	87	5·3	3·67	+ 0·05	11	..	..
Johannesburg	1022·1	− 0·9	69	32	61·1	41·1	51·1	+ 0·7	41·9	60	2·7	0·01	− 0·32	1	9·0	84
Mauritius	1021·5	+ 1·1	77	53	73·9	60·3	67·1	− 1·2	63·5	75	5·3	2·24	− 0·25	24	7·2	66
Calcutta, Alipore Obsy.	1000·0	+ 0·8	92	75	88·1	79·5	83·8	+ 0·1	79·2	90	8·6	17·18	+ 4·48	17*	..	..
Bombay	1004·2	+ 0·3	91	74	87·7	78·5	83·1	+ 1·7	77·8	83	7·8	14·13	− 10·14	15*	..	..
Madras	1004·3	− 0·2	101	73	96·5	79·8	88·1	+ 0·5	77·1	70	8·2	1·08	− 2·76	4*	..	..
Colombo, Ceylon	1010·0	+ 0·9	85	72	83·5	76·6	80·1	− 1·1	76·6	81	8·1	6·58	+ 2·15	21	4·7	38
Singapore	1008·9	0·0	93	71	88·1	75·0	81·5	+ 0·2	77·6	81	6·0	4·73	− 2·06	14	5·7	47
Hongkong	1005·5	+ 0·8	93	76	87·9	78·8	83·3	+ 0·8	78·3	79	7·8	14·31	− 0·11	20	6·8	51
Sandakan	1008·9	..	91	72	88·4	74·8	81·6	− 0·2	77·0	83	6·9	7·74	+ 1·02	17	..	..
Sydney, N.S.W.	1018·8	+ 0·5	76	41	61·1	48·5	54·8	+ 2·1	50·6	80	6·6	3·48	− 1·32	18	4·1	41
Melbourne	1019·7	+ 0·8	66	32	57·1	41·4	49·3	+ 0·6	44·4	86	5·7	3·29	+ 1·43	14	4·2	43
Adelaide	1020·3	0·0	70	37	59·7	42·5	51·1	− 0·7	45·6	71	6·2	1·75	− 0·89	15	5·2	52
Perth, W. Australia	1021·2	+ 2·2	71	38	62·4	46·3	54·3	− 0·9	49·3	75	4·2	4·99	− 1·57	16	6·6	64
Coolgardie	1021·7	+ 1·9	73	37	59·7	42·6	51·1	− 0·1	45·5	74	3·5	0·72	− 0·15	6	..	..
Brisbane	1018·1	− 0·3	73	39	67·5	51·8	59·7	+ 1·2	54·1	70	5·0	3·23	+ 1·03	10	5·8	55
Hobart, Tasmania	1017·5	+ 3·8	60	34	53·2	40·3	46·7	+ 1·0	41·9	77	5·3	1·16	− 1·02	12	4·8	51
Wellington, N.Z.	1022·6	+ 8·7	60	35	50·4	42·5	46·5	− 1·5	44·3	84	7·6	6·00	+ 0·37	19	2·5	26
Suva, Fiji	1015·3	+ 1·3	86	62	78·6	67·5	73·1	− 0·3	67·7	77	7·0	1·88	− 3·05	16	5·5	49
Apia, Samoa	1012·0	+ 0·1	86	70	83·9	72·7	78·3	+ 1·1	74·5	76	4·9	5·95	+ 2·97	15	8·1	71
Kingston, Jamaica	1013·6	− 1·1	92	69	88·0	73·5	80·7	− 1·0	73·1	80	5·5	9·86	+ 8·24	10	8·2	63
Grenada, W.I.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Toronto	1015·4	+ 1·0	98	54	83·8	62·0	72·9	+ 3·8	64·3	62	3·0	1·53	− 1·31	5	10·7	71
Winnipeg	1013·6	+ 1·3	91	47	81·3	56·9	69·1	+ 2·7	58·8	83	5·1	1·61	− 1·49	14	10·2	64
St. John, N.B.	1016·1	+ 2·5	79	47	71·4	53·8	62·6	+ 2·2	57·5	75	6·0	0·85	− 2·78	11	8·0	52
Victoria, B.C.	1017·9	+ 0·6	81	48	66·2	50·8	58·5	− 1·6	42·4	68	2·8	1·13	+ 0·71	6	11·7	75

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

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St. John, N.B.	1016·1	+ 2·5	79	47	71·4	55·8	62·6	+ 2·2	57·5	75	6·0	0·85	— 2·78	11	8·0	52
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